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UTILITY PATENT APPLICATION TRANSMITTAL <small>(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))</small>	Attorney Docket No.	97482
	First Inventor or Application Identifier	David Miller
	Title	SAWING APPARATUS AND SAW FENCE.
	Express Mail Label No.	EE687598643US

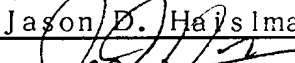
APPLICATION ELEMENTS <small>See MPEP chapter 600 concerning utility patent application contents.</small>	ADDRESS TO: Assistant Commissioner for Patents Box Patent Application Washington, DC 20231
1. <input checked="" type="checkbox"/> * Fee Transmittal Form (e.g., PTO/SB/17) <small>(Submit an original and a duplicate for fee processing)</small>	5. <input type="checkbox"/> Microfiche Computer Program (Appendix)
2. <input checked="" type="checkbox"/> Specification [Total Pages 39] <small>(preferred arrangement set forth below)</small> <ul style="list-style-type: none">- Descriptive title of the Invention- Cross References to Related Applications- Statement Regarding Fed sponsored R & D- Reference to Microfiche Appendix- Background of the Invention- Brief Summary of the Invention- Brief Description of the Drawings (if filed)- Detailed Description- Claim(s)- Abstract of the Disclosure	6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary) <ul style="list-style-type: none">a. <input type="checkbox"/> Computer Readable Copyb. <input type="checkbox"/> Paper Copy (identical to computer copy)c. <input type="checkbox"/> Statement verifying identity of above copies
3. <input checked="" type="checkbox"/> Drawing(s) (35 U.S.C. 113) [Total Sheets 19]	ACCOMPANYING APPLICATION PARTS
4. Oath or Declaration [Total Pages <input]<ul="" type="checkbox"/> a. <input type="checkbox"/> Newly executed (original or copy) b. <input type="checkbox"/> Copy from a prior application (37 C.F.R. § 1.63(d)) <small>(for continuation/divisional with Box 16 completed)</small><ul style="list-style-type: none">i. <input type="checkbox"/> DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).	7. <input type="checkbox"/> Assignment Papers (cover sheet & document(s))
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	11. <input type="checkbox"/> Preliminary Amendment
	12. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503) <small>(Should be specifically itemized)</small>
	13. <input type="checkbox"/> * Small Entity Statement filed in prior application, Status still proper and desired <small>(PTO/SB/09-12)</small>
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16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____
Prior application information: Examiner: _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

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Signature		Date	8/14/98

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<h1 style="margin: 0;">FEE TRANSMITTAL</h1> <p style="margin: 0; font-size: small;">Patent fees are subject to annual revision on October 1. These are the fees effective October 1, 1997. Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12. See 37 C.F.R. §§ 1.27 and 1.28.</p>		<p>Complete if Known</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Application Number</td><td></td></tr> <tr><td>Filing Date</td><td></td></tr> <tr><td>First Named Inventor</td><td>David Miller</td></tr> <tr><td>Examiner Name</td><td></td></tr> <tr><td>Group / Art Unit</td><td></td></tr> <tr><td>Attorney Docket No.</td><td>97482</td></tr> </table>		Application Number		Filing Date		First Named Inventor	David Miller	Examiner Name		Group / Art Unit		Attorney Docket No.	97482
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TOTAL AMOUNT OF PAYMENT		(\$ 2,148.00)													

<p>METHOD OF PAYMENT (check one)</p> <p>1. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:</p> <p>Deposit Account Number: 11-1110</p> <p>Deposit Account Name: Kirkpatrick & Lockhart LLP</p> <p><input checked="" type="checkbox"/> Charge Any Additional Fee Required Under 37 C.F.R. §§ 1.16 and 1.17 <input type="checkbox"/> Charge the Issue Fee Set in 37 C.F.R. § 1.18 at the Mailing of the Notice of Allowance</p> <p>2. <input checked="" type="checkbox"/> Payment Enclosed: <input checked="" type="checkbox"/> Check <input type="checkbox"/> Money Order <input type="checkbox"/> Other</p> <p style="text-align: center;">FEE CALCULATION</p> <p>1. BASIC FILING FEE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Large Entity Code</th> <th>Small Entity Code</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>101</td><td>790</td><td>201 395 Utility filing fee</td><td>790.</td></tr> <tr><td>106</td><td>330</td><td>206 165 Design filing fee</td><td></td></tr> <tr><td>107</td><td>540</td><td>207 270 Plant filing fee</td><td></td></tr> <tr><td>108</td><td>790</td><td>208 395 Reissue filing fee</td><td></td></tr> <tr><td>114</td><td>150</td><td>214 75 Provisional filing fee</td><td></td></tr> <tr> <td colspan="3" style="text-align: right;">SUBTOTAL (1)</td> <td>(\$790.00)</td> </tr> </tbody> </table> <p>2. 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Signature		Date 8/14/98		Deposit Account User ID	

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TITLE

Sawing Apparatus and Saw Fence System

INVENTORS

5 David Miller, a citizen of the United States residing at 1908 Swallow
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Jerry W. Ford, a citizen of the United States residing at 181 Road 648,
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CROSS-REFERENCE TO RELATED APPLICATIONS

15 Not applicable.

STATEMENT REGARDING FEDERALLY
SPONSORED RESEARCH AND DEVELOPMENT

Not applicable.

5 TECHNICAL FIELD AND INDUSTRIAL
APPLICABILITY OF THE INVENTION

The present invention relates to sawing apparatus including a work surface for supporting a workpiece, and more particularly relates to a powered table saw including a rail system for positioning of a fence on the work surface of the saw and that
10 may further include a dust collection system for channeling and collecting dust created during the sawing operation. The present invention also relates to a device for positioning a workpiece on the work surface of a sawing apparatus and more particularly relates to a table saw fence for positioning a workpiece on the work surface of the saw relative to the circular blade of the saw including an adjustable integral support member
15 for at least partially supporting the workpiece when it is being advanced along the work surface of the table saw.

DESCRIPTION OF THE INVENTION BACKGROUND

Presently available workpiece fences adapted for use with powered table
20 saws typically are not constructed so as to support the workpiece during cutting operations. In particular, the presently available table saw fences do not provide adequate

and effective support to a workpiece when performing lengthwise or “rip” cuts.

Predictably, individuals have sought to address this need by introducing aftermarket table saw fences that include additional elements for the purpose of supporting the workpiece during such cutting operations. However, such devices have proven to be ineffective for
5 a number of reasons. In particular, they fail to provide consistent support to the workpiece throughout their surfaces, they generally are difficult to adjust relative to the plane of the work surface of the saw, and they may at least partially obstruct the area in front of the saw that is normally occupied by the operator.

Compounding the relative lack of utility of many of the available table
10 saw fences is the fact that presently available table saws, and other sawing or cutting devices including work surfaces, generally do not provide convenient means for securing accessory devices, such as workpiece fences and the like, to the work surface. In particular, existing table saws employ a variety of rails and/or brackets to secure workpiece fences and other work holding and positioning accessories to the work surface.
15 In particular, the design of commonly available table saw rails do not provide for rapid readjustment of the workpiece fence during cutting operations. In addition, the commonly available rails often require a gap between the table saw’s work surface and the rail. This gap provides a channel through which objects resting on the work surface may fall or in which such objects may become trapped.

20 In addition, commonly available powered table saws typically lack effective means for providing for the disposal of debris produced by the cutting operations. In particular, in commonly available powered table saws, debris produced by

cutting operations, for example saw dust, stock, and other scrap, falls from the work surface to the floor areas beneath and around the perimeter of the saw, thereby complicating clean up and generally lending an untidy appearance to the workshop.

Accordingly, there exists a need for a workpiece fence for a powered table saw, and other sawing devices having a work surface, which provides a conveniently adjustable means for at least partially supporting a workpiece when it is being advanced along the work surface and which does not significantly obstruct the area occupied by an operator.

There also exists a need for a sawing apparatus or other cutting including an improved rail system.

There is still another need for a saw dust/saw scrap collection system that does not allow such material to collect beneath and around the perimeter of the table saw or other sawing device.

SUMMARY OF THE INVENTION

In accordance with a particularly preferred form of the present invention, there is provided a workpiece guide for guiding and supporting workpieces during cutting operations of a cutting device having at least one rail and a work surface. In a preferred form, the workpiece guide comprises an elongate body and an infeed extension integral thereto.

Another embodiment of the present invention comprises a saw. The saw further comprises a work surface, a rail system, and a workpiece guide. The work surface comprises a substantially horizontal plane having an infeed side and an outfeed side. The rail system comprises an infeed rail disposed along the infeed side of the work surface
5 and an outfeed rail disposed along the outfeed side of the work surface. The workpiece guide is slidably disposed on the rail system and comprises an elongated body having an infeed end and an outfeed end and an infeed extension.

Yet another embodiment of the present invention includes a saw comprising a support structure, a housing, and a debris collection system. The housing is positioned
10 atop the support structure and comprises a cutting member adapted to cut workpieces. The debris collection system is attached to the support structure and positioned beneath the housing. The debris collection system comprises an inclined flow surface having a lower edge and at least one side edge.

The present invention also comprises a saw for cutting workpieces having a work
15 surface and a rail system. The work surface has an infeed side and an outfeed side. The rail system comprises an infeed rail having a U-shaped cross-section disposed adjacent to the infeed side of the work surface and an outfeed rail having an L-shaped cross section disposed adjacent to the outfeed side of the work surface.

It is a feature of the present invention to provide a workpiece guide for a cutting
20 device having a unique infeed surface that provides consistent support to a workpiece during cutting operations.

It is another feature of the present invention to provide a workpiece guide for a saw having a unique infeed surface that is easily and readily adjustable relative to the work surface of the saw.

It is yet another feature of the present invention to provide a unique workpiece
5 guide for a saw having a work surface that does not significantly obstruct the area occupied by the operator of saw.

Yet another feature of the present invention is to provide a workpiece guide for a saw having a work surface that provides a more convenient apparatus for securing the workpiece guide to the work surface of the saw prior to cutting operations and for
10 readjusting the workpiece guide to the work surface of the saw during cutting operations.

It is another feature of the present invention to provide an improved saw rail system for securing accessories, including a workpiece guide, to the work surface of the saw prior to cutting operations and for readjusting such accessories during cutting operations.

It is yet another feature of the present invention to provide a unique rail system for
15 a saw that may be positioned immediately adjacent to and abutting the work surface of the saw.

It is another feature of the present invention to provide a novel debris collection system for a saw that does not allow such material to collect beneath and around the
20 perimeter of the saw.

Accordingly, the present invention provides solutions to the shortcomings of prior sawing apparatus, workpiece guides, and debris collection systems. Those of ordinary skill in the art will readily appreciate, however, that these and other details,

features and advantages will become further apparent as the following detailed description of the preferred embodiments proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

5 In the accompanying Figures, there are shown embodiments of the present invention wherein like reference numerals are employed to designate like parts and wherein:

Figure 1 is a right side perspective view of an embodiment of the workpiece guide system and debris collection system of the present invention in use on a powered table
10 saw;

Figure 2 is a left side perspective view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

Figure 3 is an infeed side elevational view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

15 Figure 4 is an outfeed side elevational view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

Figure 5 is a right side elevational view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

Figure 6 is a left side elevational view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

Figure 7 is a top view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

5 Figure 8 is a bottom view of the powered table saw of Figure 1, including the workpiece guide system and debris collection system depicted in Figure 1;

Figure 9 is an isometric view of the debris collection system included in Figure 1, shown in isolation;

Figure 10 is a side cross-sectional view of the debris collection system of
10 Figure 9, taken along the line 10-10 in Figure 9;

Figure 11 is a side cross-sectional view in isolation of the infeed rail of the workpiece guide system included in Figure 1;

Figure 12 is a side cross-sectional view in isolation of the outfeed rail of the workpiece guide system included in Figure 1, in isolation;

15 Figure 13 is a plan view of the workpiece guide of the workpiece guide system included in Figure 1;

Figure 14 is a side elevational view of the workpiece guide of Figure 13;

Figure 15 is a top view of the workpiece guide of Figures 13 and 14;

Figure 16 is a bottom view of the workpiece guide of Figures 13-15;

Figure 17 is a side view depicting the workpiece guide of Figures 13-16 shown positioned on the infeed rail and in the open position;

Figure 18 is a side view depicting the workpiece guide of Figures 13-16 shown positioned on the infeed rail and in the clamped position; and

5 Figure 19 is a side view of the means of attachment between the workpiece guide of Figures 13-16 and the outfeed rail.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings for the purpose of illustrating embodiments
10 of the inventions only and not for the purposes of limiting the same, the figures show the present inventions adopted for use in connection with a powered table saw 10. While the present inventions are particularly well-suited for use in connection with a powdered table saw 10, one of ordinary skill in the art will appreciate that the present inventions may be successfully employed in connection with various other types of saws and cutting
15 devices having workpiece support surfaces, such as miter saws, band saws, and the like. Accordingly, the protection afforded to the inventions claimed herein may not be limited solely to their use in connection with a table saw 10 of the type depicted in the present figures. Because the general mode of operations of powered table saws is well known, only those features of the table saw 10 that are helpful in illustrating the mode of
20 embodiments of the present inventions are discussed below.

The table saw 10 depicted in Figures 1-8 includes a work surface 12, a housing 14, and a support structure 15. The work surface 12 includes a rectangular-shaped, generally planar surface formed from a rigid material such as steel or the like and having opposite, generally parallel infeed and outfeed edges 16 and 18, respectively. The infeed and outfeed edges 16 and 18 have been referred to in that manner because it is typically the case that a workpiece being advanced along the work surface 12 is first advanced past the infeed edge 16 and then passes the outfeed edge 18 after exiting the circular cutting member 22. The work surface 12 further includes a slot 20 therethrough that has a longitudinal axis that is generally perpendicular to the infeed and outfeed edges 16 and 18. The slot 20 is adapted to allow a cutting member 22 to protrude therethrough, and the slot 20 will include an insert therein (not shown), having a shape corresponding to the portion of the cutting member 22 that protrudes through slot 20, to at least partially prevent the passage through the work table 12 of material cut by the cutting member. In the case of table saw 10, the cutting member 22 is a circular blade that is journaled for rotation within slot 20 about a shaft (not shown). A cutting member guard 23 is typically provided over the cutting member 22. The work surface 12 further may include one or more channels 24 running parallel to the plane of the cutting member 22 and perpendicular to the infeed and outfeed edges 16 and 18, and which may accept a miter gauge (not shown).

The work surface 12 is supported by and affixed atop the housing 14. In addition to supporting the work surface 12, the housing 14 generally provides a cavity for placement of the saw's motor and other control equipment. The housing 14 in the embodiment of table saw 10 depicted in the figures includes a supporting framework,

four sides, and an open bottom. Accordingly, it will be appreciated that sawdust, cut stock, and other small debris that is produced by the cutting member 22 and falls through work surface 12 may pass through the housing 14 without becoming trapped therein.

The housing 14 is supported atop support structure 15. The support
5 structure 15 includes four legs 26, formed from a rigid material such as steel or the like, and adapted and sized to support the housing 14 and work surface 12 in a generally horizontal position. The legs 26 may also include at least one storage bore 27 therethrough. The storage bore 27 is adapted to accept and store therein a variety of saw accessories when they are not in use including, for example, a miter gauge (not shown).
10 The support structure 15 may additionally include cross-members 25 affixed amongst and between the legs 24, using for example, bolts, screws, rivets, welds, or the like, to increase the stability and rigidity of the support structure 15. In an alternative, the cross-members 25 and legs 24 are formed from a one-piece design by, for example, stamping.

The support structure 15 may also include a unique and novel debris
15 collection system comprising a debris chute 30. A preferred configuration of debris chute 30 of the present invention will now be described with reference to Figures 1-10. As can be seen in particular in Figures 1-8, the debris chute 30 is affixed to the legs 26 and disposed immediately beneath the open bottom of the saw housing 14. The debris chute 30 is adapted to catch any dust or other cutting debris produced by the action of the
20 cutting member 22 that falls through the work table 12 and passes through the open bottom of housing 14. The debris chute 30 is preferably positioned on an incline having a slope running downward in a direction generally from the infeed edge 16 toward the outfeed edge 18 of work surface 12. Accordingly, it will be appreciated by the skilled

artisan that the debris chute 30 utilizes the force of gravity to direct any debris landing thereon toward the lower edge 33 of the debris chute, which opens away from the position typically occupied by an operator.

As can be seen in particular in Figures 9 and 10, the debris chute 30 may generally include a flow surface 32 bordered along one side by a shelf 34. The flow surface 32 may be in the form of a generally planar rectangular sheet formed of rigid material such as steel or the like, and having a smooth surface area throughout. The accessory shelf 34 includes a flange preferably formed from the same material as the flow surface 37 and is disposed along the length of one side of the flow surface 32, integral thereto. The shelf 34 is adapted to hold saw accessories, for example, a saw fence, thereon when they are not in use. Thus, unlike conventional arrangements in which debris is allowed to fall directly onto the floor beneath the saw, it will be appreciated that the debris chute 30 is adapted to guide debris falling onto the flow surface 32 to the lower edge 33 thereof. The lower edge 33 of debris chute 30 may additionally be provided with a debris reservoir (not shown) disposed along the length thereof to collect sawdust and other debris directed to the lower edge 33. The debris reservoir may include, for example, a box or bag adapted to catch and hold any debris traveling down the debris chute 30 and provide for improved ease in the disposal thereof. Accordingly, the debris chute 30 represents an improvement over conventional arrangements in that it restricts the area of distribution of sawdust and other cutting debris around the saw 10 and provides for increased ease of clean-up for the workshop or other location of the table saw 10.

The table saw 10 may further include a novel rail system 40 for the attachment of accessories such as workpiece fences and other workpiece holding and

positioning accessories thereto. A preferred rail system 40 of the present invention will now be described with reference to Figures 1-8 and 11-12. As can be seen in those Figures, the rail system 40 generally includes an infeed rail 42 and an outfeed rail 50. The infeed rail 42 is in the form of an elongate bar, formed from a rigid material such as aluminum, steel or the like, and having a generally U-shaped cross-section throughout its length. Thus, as seen in particular in Figure 11, the U-shaped cross-section of the infeed rail 42 defines a trough 43 having an inner arm 44, an outer arm 45, and a bottom 46. Such an arrangement provides an improved selection of surfaces for clamping accessory devices such as workpiece guide 60 (the operation and construction of which will be described below) to saw 10. The infeed rail 42 is disposed parallel to the infeed edge 16 of the work surface 12 and is fixedly connected thereto by, for example, bolts, welds, or other suitable connectors known in the art. This particularly advantageous construction allows the infeed rail 42 to be disposed so as to directly abut infeed edge 16 of work surface 12 over its entire length such that no gap exists between infeed rail 42 and infeed edge 16. That arrangement is particularly shown in Figure 7 and also is illustrated in Figure 18, described in greater detail below.

In conventional rail arrangements, the infeed rail is typically a tubular member that must be positioned such that a gap exists between the rail and the work surface. Such an arrangement provides a space in which objects may become trapped and through which sawdust and other cutting debris may fall to the floor. It will be appreciated that the present rail system 40 addresses such drawbacks. As can be seen in particular in Figures 1-3, 7, and 8, the length of infeed rail 42 may be greater than that of

the infeed edge 16 of work surface 12. Accordingly, a portion of infeed rail 42 may extend beyond the length of the infeed edge 16 of work surface 12 in order to increase the possible travel distance of accessories attached to the rail system 40.

The outfeed rail 50 of the rail system 40 includes an elongate member,
5 formed from a rigid material such as steel, aluminum, or the like, and having a generally L-shaped cross-section throughout its length. Thus, as seen in particular in Figure 12, the L-shaped cross-section of the outfeed rail 50 serves to define a bracket including a mounting plate 52 and a bracket plate 54 disposed in planes generally perpendicular to one another. The outfeed rail 50 is disposed parallel to the outfeed edge 18 of the work
10 surface 12 and is fixedly mounted thereto by, for example, bolts, welds, or other suitable connectors. Such an arrangement provides improved clamping surfaces for attaching a portion of accessories, such as, for example, workpiece guide 60 (the operation and construction of which will be described below), across the work surface 12 of the table saw 10. Preferably, the outfeed rail 50 is disposed such that mounting plate 52 directly
15 abuts the outfeed edge 18 of work surface 12 over its entire length such that no gap exists between outfeed rail 50 and outfeed edge 18. The positioning of the outfeed rail 50 in that way is indicated by, for example, Figures 7 and 19, the latter of which is described in greater detail below. Thus, it will be appreciated that the construction and positioning of the outfeed rail 50 may provide all or many of the same advantages derived from the
20 construction and positioning of the infeed rail 42. The length of outfeed rail 50 may equal that of infeed rail 42, and as can be seen in particular in Figures 1-3, 7, and 8, the length of outfeed rail 50 may be greater length than that of outfeed edge 18 to augment

the possible positioning of accessories attached to the rail system 40 relative to the cutting member 22.

As noted above, rail system 40 is conveniently adapted for use in attaching accessories to saw 10. One such accessory is workpiece guide 60 which is particularly adapted for use with the above-described embodiment of the rail system 40, and which incorporates novel features particularly adopted for positioning workpieces relative to the cutting member 22. However, although workpiece guide 60 is described herein for use in connection with rail system 40 and table saw 10, it will be appreciated that the workpiece guide 60 of the present invention may also be employed with other conventional rail systems and with cutting devices other than table saw 10. A possible construction of workpiece guide 60 will now be described with reference to Figures 1-8 and 13-19. As can be seen in particular in Figures 13-19, the workpiece guide 60 is adapted to be positioned atop work surface 12 and to span the length thereof in a substantially parallel relation to the plane of cutting member 22. Workpiece guide 60 is further adapted to selectively engage and slidably ride on rail system 40. Workpiece guide 60 generally includes a saw fence having body 62, an infeed extension 64, and an attachment mechanism 66. The body 62 generally includes an elongate member, formed from a rigid material such as steel, aluminum, or the like, and having an infeed end 63 and an outfeed end 65. The length of body 62 is preferably greater than the width of the table saw 10 (defined herein as the distance between the infeed rail 42 and outfeed rail 50) such that the body 62 will overhang and extend beyond infeed rail 42 and outfeed rail 50.

The body 62 has rectangular cross-section which serves to define a hollow interior region 68 having a top surface 70, a bottom surface 71, and side faces 72 and 73. Preferably, the top surface 70 additionally includes one or more slots 74 therein. The slots 74 preferably include channels, having a T-shaped cross-section, and spanning the length of body 62. The T-shaped cross-section of the slots 74 is adapted to accept various saw accessories including, for example, fingerboards, push sticks, and other accessories as are known in the art. (See Figure 13) The side faces 72 and 73 include smooth surfaces positioned generally perpendicular to the plane of top and bottom surfaces 70 and 71, respectively, and adapted to allow workpieces to slide therealong. The bottom surface 71 preferably includes a pair of slots 76 disposed thereon and running the length thereof. The pair of slots 76 preferably include two channels 77 and 78 having T-shaped cross-sections and adapted to accept attachment mechanism 66 therein. (See Figure 16) The construction and operation of attachment mechanism 66 will be further described further below.

The present workpiece guide 60 also includes a unique and novel infeed extension 64, the construction and operation of which will now be described. The infeed extension 64 generally includes a delta-shaped work supporting surface 67 portion, integral to the body 62, and formed from a rigid material such as aluminum, steel or the like. (See Figures 13, 15, and 16) The work supporting surface 67 of the infeed extension 64 is oriented beneath body 62 at the infeed end 63 thereof. Accordingly, the infeed extension 64 serves to define two infeed platforms 85 and 86 positioned adjacent to side faces 72 and 73 of body 62, respectively, and which may be positioned so that the

work supporting surface 67 is generally coplanar with work surface 12 when workpiece guide 60 is mounted on saw 10. The infeed extension 64 is further adapted to abut infeed edge 16 of work surface 12 and to form a protrusion therefrom extending beyond infeed rail 42, generally in the direction of the operator. (See Figures 1, 2, and 7) The infeed extension 64 may also include an indicator 120 in the surface thereof for reading witness lines (not shown) on the infeed rail 42 so as to indicate the distance between the side faces 72 and 73 of the body 62 and the cutting member 22. The infeed extension 64 may support workpieces that are being advanced into the cutting member 22 and that extend beyond the infeed edge 16 of the work surface 12. It will thus be appreciated that the inclusion of infeed extension 64 on workpiece guide 60 represents an improvement over the prior art in that it provides for increased support of workpieces being fed into the saw 10 during, for example, rip-cutting operations.

Preferably, workpiece guide 60 further includes elements adapted to support infeed extension 64 and to maintain the regions of work supporting surface 67 of infeed platforms 72 and 73 generally coplanar with work surface 12. A slide rail 80 and height adjustment mechanisms 83 and 84 are adapted to slidably support infeed extension 64 and workpiece guide 60 on infeed rail 42 and are further adapted to selectively adjust the height and attitude of the work supporting surface 67 of infeed extension 64 relative to work surface 12. Slide rail 80 generally includes an L-shaped bracket member defined by arms 81 and 82 running transverse to body 62 beneath infeed extension 64 and adapted to slidably engage infeed rail 42. The relationship of those elements is indicated in, for example, Figures 14, 17, and 19. In particular, when the workpiece fence 60 is

positioned on table saw 10, arm 81 is oriented generally parallel with the surface of infeed extension 64 and is adapted to sit atop outer arm 45 of infeed rail 42. Arm 82 is oriented generally perpendicular to the surface of infeed extension 64 and is adapted to be slidably seated within trough 43 abutting outer arm 45, as is generally shown in Figures 5 17 and 18. Arm 82 may additionally include lateral adjustment mechanism 88 protruding therefrom in the direction of inner arm 44 of infeed rail 42. Lateral adjustment mechanism 88 includes threaded members 87 and 89. The threaded members 87 and 89 may include bolts, screws, or the like that are seated within threaded bores (not shown) in the surface of arm 82. Accordingly, it will be appreciated that threaded members 87 and 10 89 may be selectively adjusted within the threaded bores (not shown) to seat against inner arm 44 and thereby increase the contact pressure between slide rail 80 and trough 43. Such construction allows for adjustment of the force required to slide the fence 60 along infeed rail 42. Such construction also increases the stability of the fence 60 within infeed rail 42. Accordingly, such construction of the fence 60 and infeed rail 42 provides 15 consistent support to workpieces placed thereon.

The present infeed extension 64 further includes height adjustment mechanisms 83 and 84 adapted to adjustably support infeed extension 64 on infeed rail 42 within trough 43. The height adjustment mechanisms 83 and 84 are adapted to adjust the height of infeed extension 64 relative to work surface 12 and to allow the work 20 supporting surface 67 of infeed extension 64 to be adjusted so as to be generally coplanar with work surface 12. Accordingly, height adjustment mechanisms 83 and 84 include bases 90 and 91 mounted to each infeed platform 85 and 86, respectively, by a threaded

member 93 and 94, respectively, as indicated in Figure 13. Threaded members 93 and 94 may be, for example, screws, bolts, or other suitable members characterized by a threaded shaft having a head at one end and a base 90 and 91 is secured to the threaded end of each threaded member 93 and 94, respectively. Threaded members 93 and 94 are mounted in
5 threaded bores 95 and 96, respectively, positioned along the edge of infeed platforms 85 and 86, respectively. Bases 90 and 91 are adapted to be seated atop infeed rail 42. The heads of threaded members 93 and 94 are preferably adapted for actuation by conventional means such as a screw driver, allen wrench, or the like, and are recessed within threaded bores 95 and 96 such that they do not protrude from the work supporting
10 surface 67 of the infeed platforms 85 and 86. Accordingly, it will be understood that rotation of the threaded members 93 and 94 within the threaded bores 95 and 96 will cause infeed platforms 95 and 96, respectively, to be raised or lowered relative to infeed rail 42. It will further be appreciated that the threaded members 93 and 94 may be independently adjusted within threaded bores 95 and 96, respectively, to independently
15 adjust the height of the infeed platforms 85 and 86, respectively. The present infeed extension 64 thus represents an improvement over the prior art because it is fully supported on infeed rail 42 and does not obstruct the area normally occupied by the operator, and also is easily adjustable during use.

Workpiece guide 60 further includes attachment mechanism 66 adapted to
20 releasably secure the workpiece guide 60 to the rail system 40. While the workpiece guide 60 depicted and described herein is particularly adapted to be used with rail system 40, it will be appreciated that the workpiece guide 60 of the present invention may be

adapted for use with a variety of conventional rail systems as well. As shown in particular in Figures 13-19, the attachment mechanism 66 includes an infeed rail attachment mechanism 97 and an outfeed rail attachment mechanism 98. The outfeed rail attachment mechanism 98 includes a bracket 98' formed from a rigid material such as steel or the like, defining a slot 99 adapted to accept bracket plate 54 of outfeed rail 50 therein, as is shown in Figure 19. Accordingly, it will be appreciated that the outfeed rail attachment mechanism 98 is adapted to prevent the fence 60 from lifting off of the work surface 12 during use and maintains the fence 60 in a parallel relation to the plane of cutting member 22. The outfeed rail attachment mechanism 98 is slidably attached to body 62 by fasteners 100 and 101, which are seated within slots 76 on the bottom 71 of body 62 and are adapted to anchor the outfeed rail attachment mechanism 98 to body 62. Accordingly, the fasteners 100 and 101 are adapted to fit within the T-shaped cross-section of slots 76 and may be positioned and secured at a selected location along the length thereof. Fasteners preferably include threaded nuts disposed within the slots 76 and bolts or screws running through mounting plate 52 threaded therethrough. Thus, it will be appreciated that fasteners 100 and 101 may be selectively tightened to fixedly clamp the outfeed rail attachment mechanism 98 at any point along the length of the body 62 and may be loosened to provide for free movement of outfeed rail attachment mechanism 98 along the length of body 62. Accordingly, such construction allows workpiece guide 60 of the present invention to be adjusted to fit cutting devices having work surfaces of various sizes.

Infeed rail attachment mechanism 97 includes a clamp 104, a clamp plate 106, and a lever 108. As shown in particular in Figures 17 and 18, the clamp 104 includes a cam-shaped surface 105 thereon. Clamp 104 is journaled to body 62 beneath infeed extension 64 at the infeed end 63 of the body 62 so that it may rotate about a shaft 107. Clamp plate 106 is in the form of a curved plate, formed from a rigid material such as steel, and having an inner surface that generally corresponds to cam-shaped surface 105 of clamp 104. As indicated in Figure 17, the clamp plate 106 is at least partially disposed between clamp 104 and infeed rail 42 when the workpiece guide 60 is positioned on the rail system 40. The cam further include lever 108 integral thereto.

10 Lever 108 includes a shaft, which may include a handle 110 at the end thereof, and that is adapted to rotate clamp 104 about shaft 107. Lever 108 and clamp 104 are preferably formed from a single unitary piece of rigid material, such as steel or the like, such that lever 108 protrudes therefrom and may be conveniently manipulated by an operator. However, Lever 108 may alternatively be formed from a separate piece of material that is

15 threadedly or otherwise connected to clamp 104.

The infeed rail attachment mechanism 96 may be reciprocated between either of a clamped position, shown in Figure 18, or an open position, shown in Figure 17, by the lever 108. As indicated in Figure 18, by rotating the lever 108 downward in the direction of the arrow in that figure, the surface 105 of clamp 104 is brought into

20 contact with a surface of clamp plate 106 and biases the clamp plate 106 into contact with the infeed rail 42, thereby securing the workpiece guide 60 on the rail system 40 at a desired location. To unsecure the workpiece guide 60, the lever 108 is rotated about shaft

107 in the direction of the arrow of Figure 17, thereby moving surface 105 of clamp 104 out of engagement with clamp plate 106 to release the clamping force between clamp plate 106 and infeed rail 42. Accordingly, infeed rail attachment mechanism 97 represents an improvement in that it allows for improved ease of adjustment of workpiece
5 guide 60. In particular, when lever 108 is in the unclamped position, as shown in Figure 17, surface 105 of clamp 104 is not in contact with clamp plate 106 and thus no clamping pressure is being exerted on the outer arm 45 of infeed rail 42 by infeed rail attachment mechanism 97. In this position, fence 60 is free to slide along the length of rail system 40. When lever 108 is actuated into the clamped position, as shown in Figure 18, clamp
10 plate 106 is forced into frictional contact against outer arm 45 of infeed rail 42, and workpiece guide 60 is locked in place along the length of rail system 40.

As can be appreciated from the above description, the workpiece guide and debris collection system of the present invention provide distinct advantages over conventional designs. For example, the workpiece guide provides a consistent and solid
15 infeed surface without obstructing the operator's work space. The infeed surface provides for the improved support of workpieces during, for example, rip-cutting operations. The workpiece guide adjustment features provide for height adjustment and leveling of the infeed surface. The infeed surface's integral arrangement with the body of the fence further increases the ease with which the workpiece guide may be adjusted.
20 The fence rail system of the present invention also provides advantages over prior fence rail systems. For example, the present fence rail system incorporates improved clamping surfaces and thus provides for improved ease of attachment of accessories thereto. Those

of ordinary skill in the art will, of course, appreciate that various changes in the details, materials and arrangement of parts which have been herein described and illustrated in order to explain the nature of the invention may be made by the skilled artisan within the principle and scope of the invention as expressed in the appended claims.

What is claimed is:

1. A workpiece guide for guiding and supporting workpieces during cutting operations of a cutting device having at least one rail and a work surface, said workpiece guide comprising:

an elongated body; and

an infeed extension integral to said elongated body.

2. The workpiece guide of claim 1, wherein said elongated body has an infeed end and an outfeed end and further comprises two parallel side walls and top and bottom walls said infeed extension integral to said infeed end of said elongated body and comprising an infeed platform adjacent to each of said two side walls.

3. The workpiece guide of claim 2, wherein said infeed extension further comprises at least one support adapted to slidably support said infeed extension on the at least one rail.

4. The workpiece guide of claim 3, wherein said at least one support comprises an elongated member attached to the underside of said infeed extension having a surface adapted to contact at least a portion of the rail.

5. The workpiece guide of claim 2, wherein each said infeed platform further comprises an adjustment mechanism.

6. The workpiece guide of claim 5, wherein each said adjustment mechanism comprises a threaded bore in each said infeed platform having a threaded member disposed therethrough, said threaded member adapted to exert an opposing force on the at least one rail of the saw and having a base portion and a head portion.

7. The workpiece guide of claim 6, wherein said base portion of said threaded member is adapted to slidably engage the at least one rail.

8. The workpiece guide of claim 6, wherein said head portion of said threaded member is recessed within the surface of said infeed platform.

9. The workpiece guide of claim 2, further comprising a clamp positioned adjacent to the at least one rail of the saw, for attaching said workpiece guide to the at least one rail.

10. The workpiece guide of claim 9, wherein the clamp comprises a cam and a clamp plate, said cam journaled for rotation about a shaft, said shaft attached to said workpiece guide perpendicular to said elongated body, said clamp plate having a surface complimentary in shape to said cam and positioned between said cam and the at least one rail.

11. The workpiece guide of claim 10, wherein rotation of said cam brings said cam into frictional contact with said clamp plate and said clamp plate into frictional contact with the at least one rail.

12. The workpiece guide of claim 10, wherein said clamp further comprises a lever integral to said cam, said lever for rotating said clamp about said shaft.

13. The workpiece guide of claim 1, wherein said elongated body comprises a saw fence.

14. The workpiece guide of claim 1 wherein the cutting device is a table saw.

15. A saw comprising:

a work surface comprising a substantially horizontal plane having an infeed edge and an outfeed edge;

a rail system comprising an infeed rail disposed along said infeed edge and an outfeed rail disposed along said outfeed edge; and

a workpiece guide slidably disposed on said rail system comprising an elongated body and an infeed extension, said elongated body having an infeed end and an outfeed end.

16. The saw of claim 15, wherein said elongated body has an infeed end and an outfeed end and further comprises two side walls oriented perpendicular to the work surface, said infeed extension integral to said infeed end of said body and comprising infeed platforms adjacent to each of said two side walls.

17. The saw of claim 16, wherein said infeed extension is slidably supported by said infeed rail and said infeed platforms overhang said infeed rail.

18. The saw of claim 17, wherein said infeed extension further comprises at least one support adapted to slidably support said infeed extension on said infeed rail.

19. The saw of claim 18, wherein said at least one support comprises an elongated member having a complimentary shape to at least a portion of said infeed rail.

20. The saw of claim 19, wherein each said infeed platforms further comprises an adjustment mechanism.

21. The saw of claim 20, wherein said adjustment mechanism of each said infeed platforms comprises a threaded bore in each said infeed platform having a threaded member disposed therethrough, said threaded member having a base portion and a head portion and adapted to exert an opposing force on said infeed rail.

22. The saw of claim 21, wherein said base portion of said threaded member is adapted to slidably engage said infeed rail.

23. The saw of claim 21, wherein said head portion of said threaded member is recessed within the surface of said infeed platform.

24. The saw of claim 16, further comprising a clamp positioned adjacent to said infeed rail, for fixedly clamping said workpiece guide to said infeed rail.

25. The saw of claim 24, wherein the clamp comprises a cam and a clamp plate, said cam journaled for rotation about a shaft, said shaft attached to said workpiece guide perpendicular to said elongated body, at least a portion of said clamp plate having a surface complimentary in shape to said cam and positioned between said cam and said infeed rail.

26. The saw of claim 25, wherein rotation of said cam brings said cam into frictional contact with said clamp plate and said clamp plate into frictional contact with said infeed rail.

27. The workpiece guide of claim 26, wherein said clamp further comprises a lever for actuation of said cam about said shaft, said lever integral to said cam.

28. The workpiece guide of claim 15, wherein said elongated body comprises a saw fence.

29. The saw of claim 15, wherein said infeed rail comprises an elongated member having a U-shaped cross-section disposed adjacent to said infeed edge of said work surface, and said outfeed rail comprises an elongated member having an L-shaped cross-section and being disposed adjacent to said outfeed edge of said work surface.

30. The saw of claim 29, wherein said infeed rail abuts said infeed edge of said work surface and said outfeed rail abuts said outfeed edge of said work surface.

31. The saw of claim 30, wherein said infeed rail defines a trough having an inner arm, an outer arm, and a bottom, and said outfeed rail further comprises a mounting plate and a bracket plate.

32. The saw of claim 31, wherein said inner arm of said infeed rail is attached to said infeed edge of said work surface and said mounting plate of said outfeed rail is attached to said outfeed edge of said work surface.

33. The saw of claim 15, further comprising:

a support structure;

a housing positioned atop said support structure, said work surface supported by said housing; and

a debris collection system attached to said support structure positioned beneath said housing and comprising an inclined flow surface having a lower edge, and at least one side edge.

34. The saw of claim 33, wherein:

said at least one side edge of said flow surface further comprises at least one flange integral thereto for directing debris falling thereon onto said flow surface; and

said debris collection system further comprises a debris reservoir disposed along the lower edge of said flow surface for accepting debris from said flow surface.

35. The saw of claim 34, wherein said at least one flange is angled upward relative to the plane of said inclined flow surface.

36. The saw of claim 34, wherein said inclined flow surface is disposed at an angle with said lower edge adjacent to and beneath said outfeed edge.

37. The saw of claim 36, wherein said debris reservoir further comprises a chamber having two or more integral sides, an integral bottom, and an open top for accepting debris from said flow surface, said open top disposed along the lower edge of said flow surface.

38. The saw of claim 37, wherein housing has an outer perimeter and one of said lower edge or said at least one side edge is positioned outside of said outer perimeter of said housing.

39. The saw of claim 38, wherein said saw further comprises a work surface having an outer perimeter and one of said lower edge or said at least one side edge is positioned outside of said outer perimeter of said work surface.

40. A saw comprising:

a support structure;

a housing positioned atop said support structure and comprising a cutting member adapted to cut workpieces; and

a debris collection system attached to said support structure positioned beneath said housing and comprising an inclined flow surface having a lower edge and at least one side edge.

41. The saw of claim 40, wherein:

said at least one side edge of said flow surface further comprises at least one flange integral thereto for directing debris falling thereon onto said flow surface; and

said debris collection system further comprises a debris reservoir disposed along the lower edge of said flow surface for accepting debris from said flow surface.

42. The saw of claim 41, wherein said at least one flange is angled upward relative to the plane of said inclined flow surface.

43. The saw of claim 41, wherein said saw further includes an infeed edge and an outfeed edge and said inclined flow surface is disposed at an angle with said lower edge adjacent to and beneath said outfeed edge.

44. The saw of claim 41, wherein said debris reservoir further comprises a chamber having two or more integral sides, an integral bottom, and an open top for accepting debris from said flow surface, said open top disposed along the lower edge of said flow surface.

45. The saw of claim 41, wherein body has an outer perimeter and one of said lower edge or said at least one side edges is positioned outside of said outer perimeter of said housing.

46. The saw of claim 41, wherein said saw further comprises a work surface having an outer perimeter and one of said lower edge or said at least one side edges is positioned outside of said outer perimeter of said work surface.

47. The saw of claim 40, further comprising:

a work surface attached atop said housing comprising a substantially horizontal plane having an infeed edge and an outfeed edge;

a guide rail system comprising an infeed rail disposed along said infeed edge and an outfeed rail disposed along said outfeed edge;

a workpiece guide slidably disposed on said guide rail system comprising an elongated body and an infeed extension, said elongated body having an infeed end and an outfeed end;

48. The saw of claim 47, wherein said elongated body has an infeed end and an outfeed end and further comprises two side walls oriented perpendicular to the work surface, said infeed extension integral to said infeed end of said body and comprising infeed platforms adjacent to each of said two side walls.

49. The workpiece guide of claim 48, wherein said infeed extension is slidably supported by said infeed rail.

50. The workpiece guide of claim 49, wherein said infeed extension further comprises at least one support adapted to slidably support said infeed extension on said infeed rail.

51. The workpiece guide of claim 50, wherein said at least one support comprises an elongated member attached to the underside of said infeed extension having a complimentary shape to at least a portion of said infeed rail.

52. The workpiece guide of claim 48, wherein each said infeed platforms further comprises an adjustment mechanism.

53. The workpiece guide of claim 52, wherein said adjustment mechanism of each said infeed platforms comprises a threaded bore in each said infeed platform having a threaded member disposed therethrough, said threaded member having a base portion and a head portion and adapted to exert an opposing force on said infeed rail.

54. The workpiece guide of claim 53, wherein said base portion of said threaded member is adapted to slidably engage said infeed rail.

55. The workpiece guide of claim 53, wherein said head portion of said threaded member is recessed within the surface of said infeed platform.

56. The workpiece guide of claim 48, further comprising a clamp positioned adjacent to said infeed rail, for clamping said workpiece guide said infeed rail.

57. The workpiece guide of claim 56, wherein the clamp comprises a cam and a clamp plate, said cam journaled for eccentric rotation about a shaft, said shaft attached to said workpiece guide perpendicular to said elongated body said clamp plate having a cam-shaped surface and being positioned between said cam and said infeed rail.

58. The workpiece guide of claim 57, wherein rotation of said cam brings said cam into frictional contact with said clamp plate and said clamp plate into frictional contact with said infeed rail.

59. The workpiece guide of claim 58, wherein said clamp further comprises a lever for actuation of said cam about said shaft, said lever integral to said cam perpendicular to the axis formed by said shaft.

60. The workpiece guide of claim 48, wherein said elongated body comprises a saw fence.

61. A saw for cutting workpieces having a work surface with an infeed edge and an outfeed edge, said saw comprising:

a guide rail system comprising an infeed rail having a U-shaped cross-section disposed adjacent to said infeed edge of said work surface, and an outfeed rail having an L-shaped cross-section and disposed adjacent to said outfeed edge of said work surface.

62. The saw of claim 61, wherein said infeed rail abuts said infeed edge of said work table and said outfeed rail abuts said outfeed edge of said work surface.

63. The saw of claim 62, wherein said infeed rail defines a trough having an inner arm, an outer arm, and a bottom and said outfeed rail further comprises a mounting plate and a bracket plate.

64. The saw of claim 63, wherein said inner arm of said infeed rail is attached to said infeed edge of said work surface and said outfeed rail abuts said outfeed edge of said work surface and said mounting plate of said outfeed rail is attached to said outfeed edge of said work surface.

65. The saw of claim 61, further comprising:

a workpiece guide slidably disposed on said guide rail system comprising an elongated body and an infeed extension, said elongated body having an infeed end and an outfeed end;

66. The saw of claim 65, wherein said elongated body has an infeed end and an outfeed end and further comprises two side walls oriented perpendicular to the work surface, said infeed extension integral to said infeed end of said body and comprising infeed platforms adjacent to each of said two side walls.

67. The workpiece guide of claim 66, wherein each said infeed extension is slidably supported by said infeed rail.

68. The workpiece guide of claim 67, wherein said infeed extension further comprises at least one support adapted to slidably support said infeed extension on said infeed rail.

69. The workpiece guide of claim 68, wherein said at least one support comprises an elongated member having a complimentary shape to at least a portion of said infeed rail.

70. The workpiece guide of claim 66, wherein each said infeed platforms further comprises an adjustment mechanism.

71. The workpiece guide of claim 70, wherein said adjustment mechanism of each said infeed platforms comprises a threaded bore in each said infeed platform having a threaded member disposed therethrough, said threaded member having a base portion and a head portion and adapted to exert an opposing force on said infeed rail.

72. The workpiece guide of claim 71, wherein said base portion of said threaded member is adapted to slidably engage said infeed rail.

73. The workpiece guide of claim 71, wherein said head portion of said threaded member is recessed within the surface of said infeed platform.

74. The workpiece guide of claim 66, further comprising a clamp positioned adjacent to said infeed rail, for clamping said workpiece guide said infeed rail.

75. The workpiece guide of claim 74, wherein the clamp comprises a cam and a clamp plate, said cam journaled for eccentric rotation about a shaft, said shaft attached to said workpiece guide perpendicular to said elongated body, and adjacent to said infeed rail, said clamp plate positioned between said cam and said infeed rail.

76. The workpiece guide of claim 75, wherein rotation of said cam brings the surface of said cam into frictional contact with said clamp plate and said clamp plate into frictional contact with said infeed rail.

77. The workpiece guide of claim 76, wherein said clamp further comprises a lever for actuation of said cam about said shaft, said lever integral to said cam perpendicular to the axis formed by said shaft.

78. The workpiece guide of claim 70, wherein said elongated body comprises a saw fence.

ABSTRACT OF THE DISCLOSURE

A sawing apparatus and a saw fence. The saw apparatus may include a work surface. The saw may include a rail system disposed along the edges of the work surface, for the attachment of accessories thereto. The saw may be provided with workpiece guide adapted to be attached to the rail system for guiding workpieces during the operation of the saw. The workpiece guide may also be provided with an infeed extension that rides on the rail system and is capable of supporting workpieces during the operation of the saw. The infeed extension may be adjustable relative to the work surface of the saw. The saw may further be provided with a debris collection system for the collection of debris produced by the cutting operations of the saw.

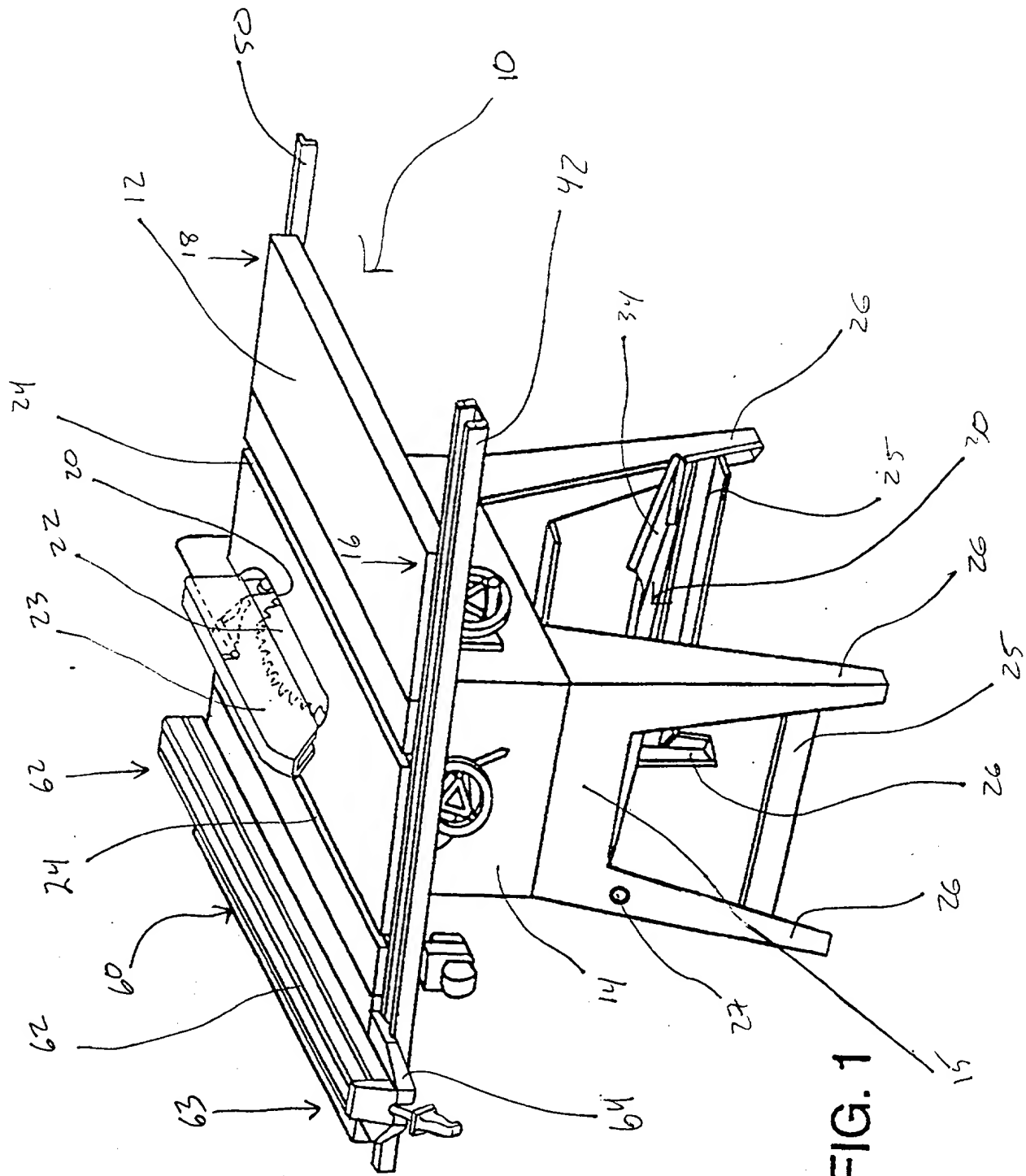


FIG. 1

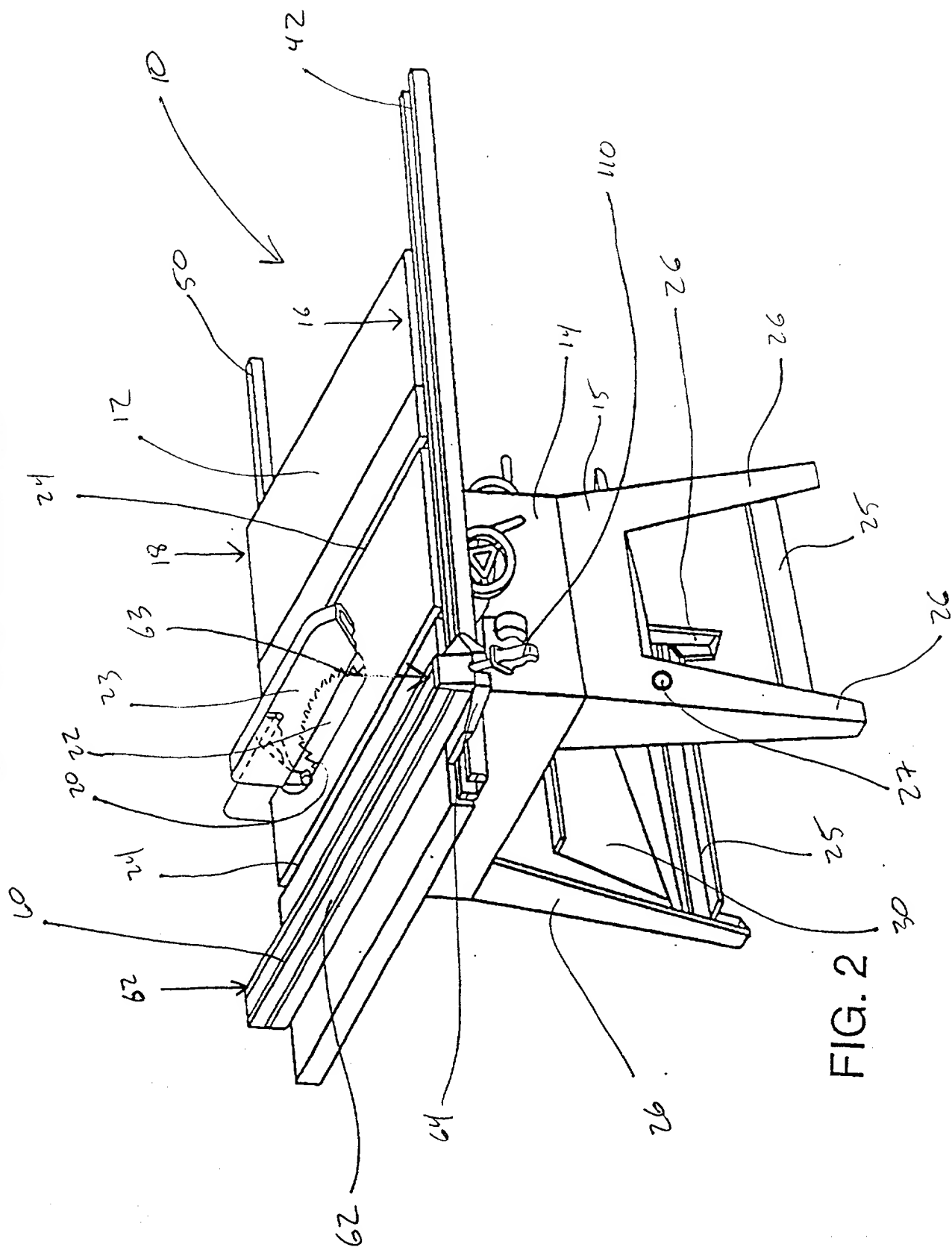


FIG. 2

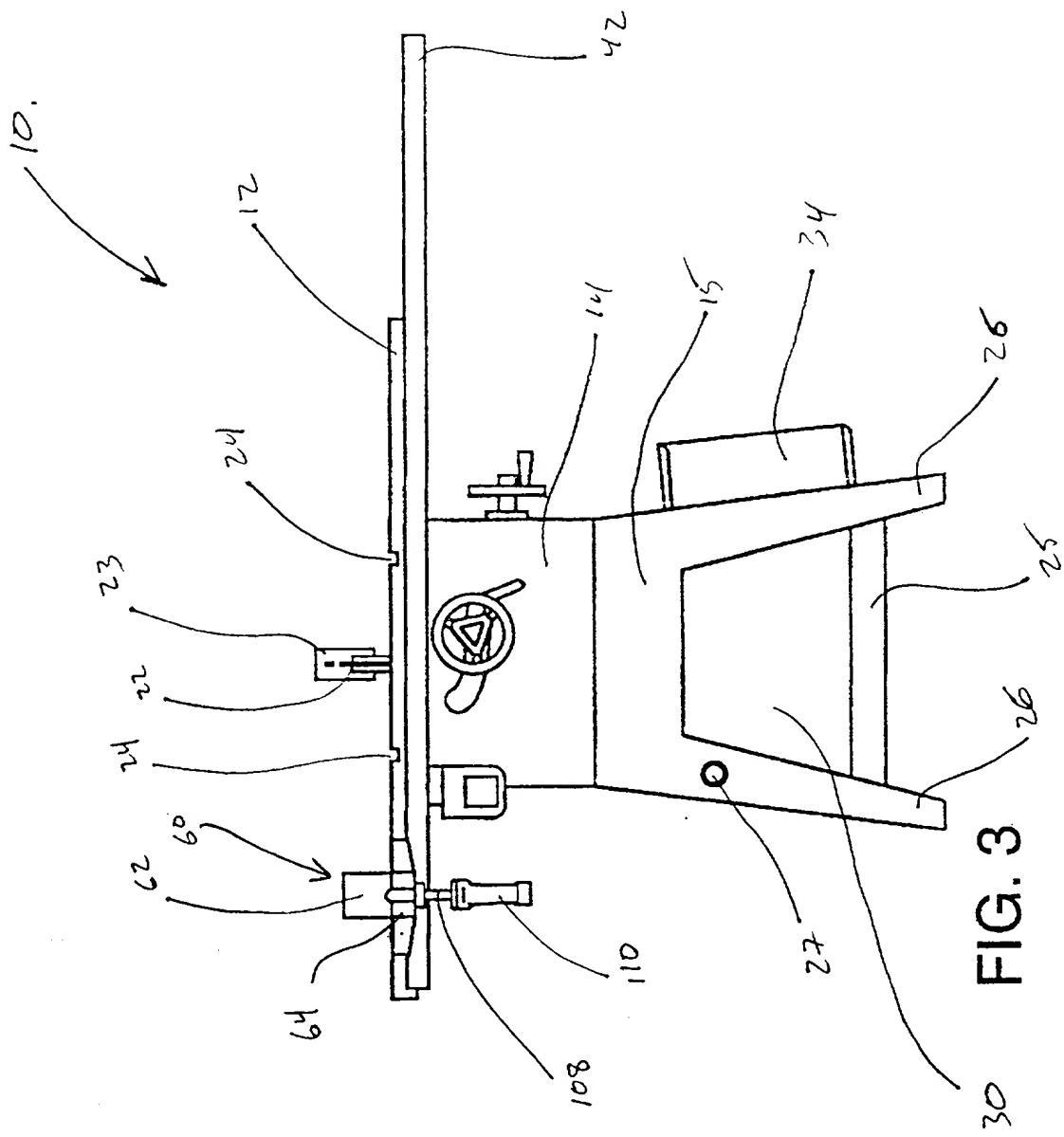


FIG. 3

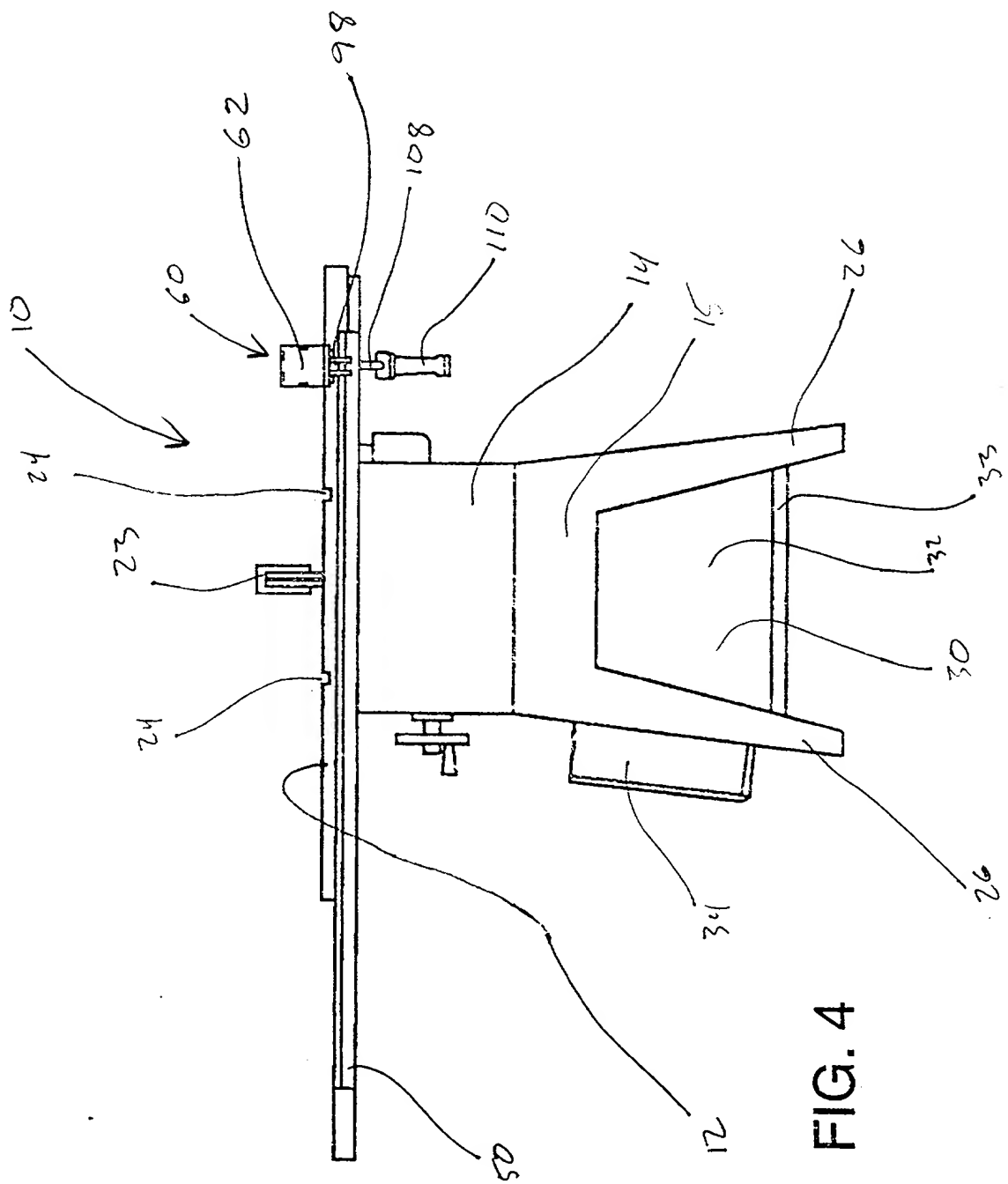


FIG. 4

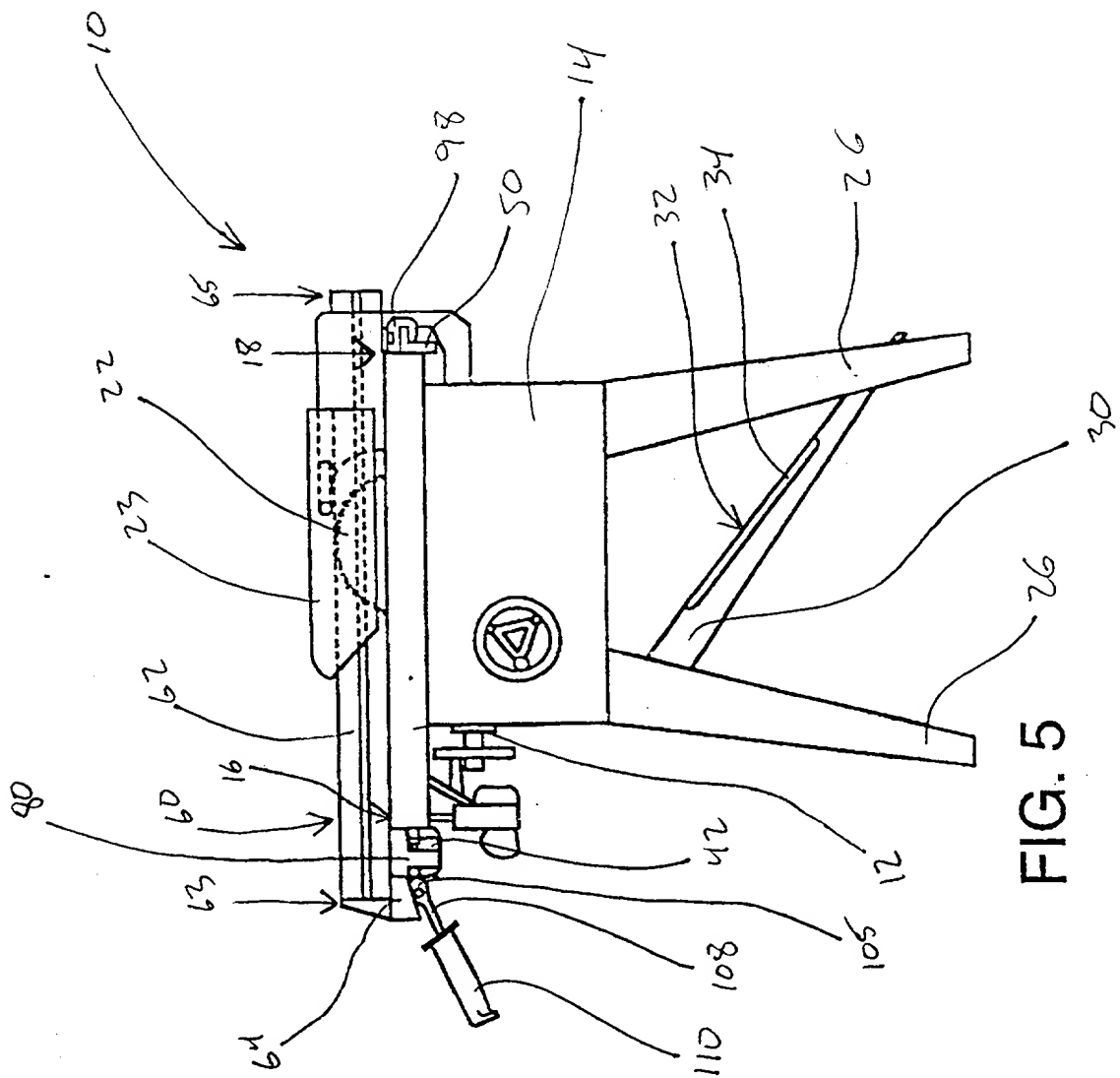
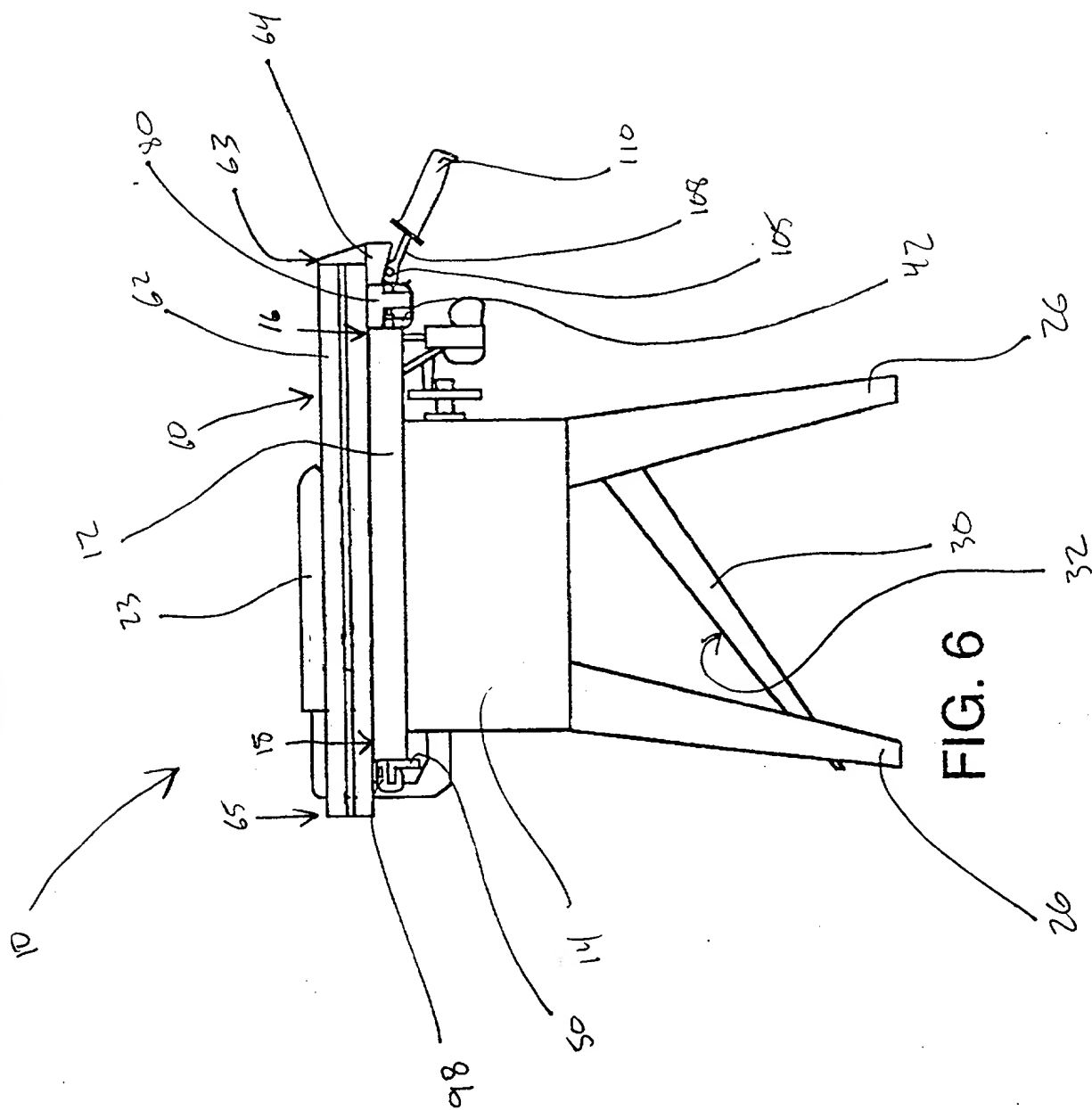
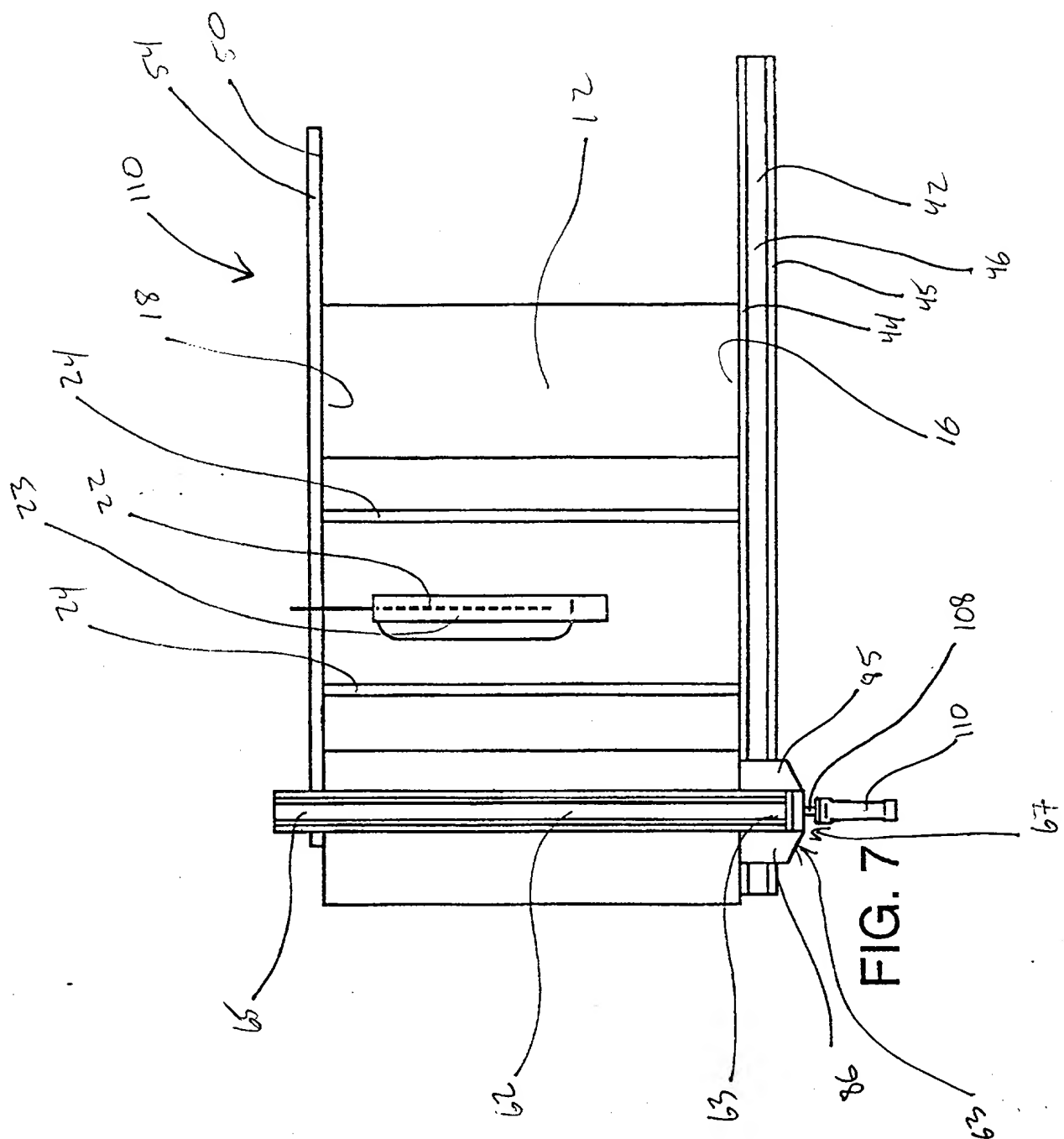
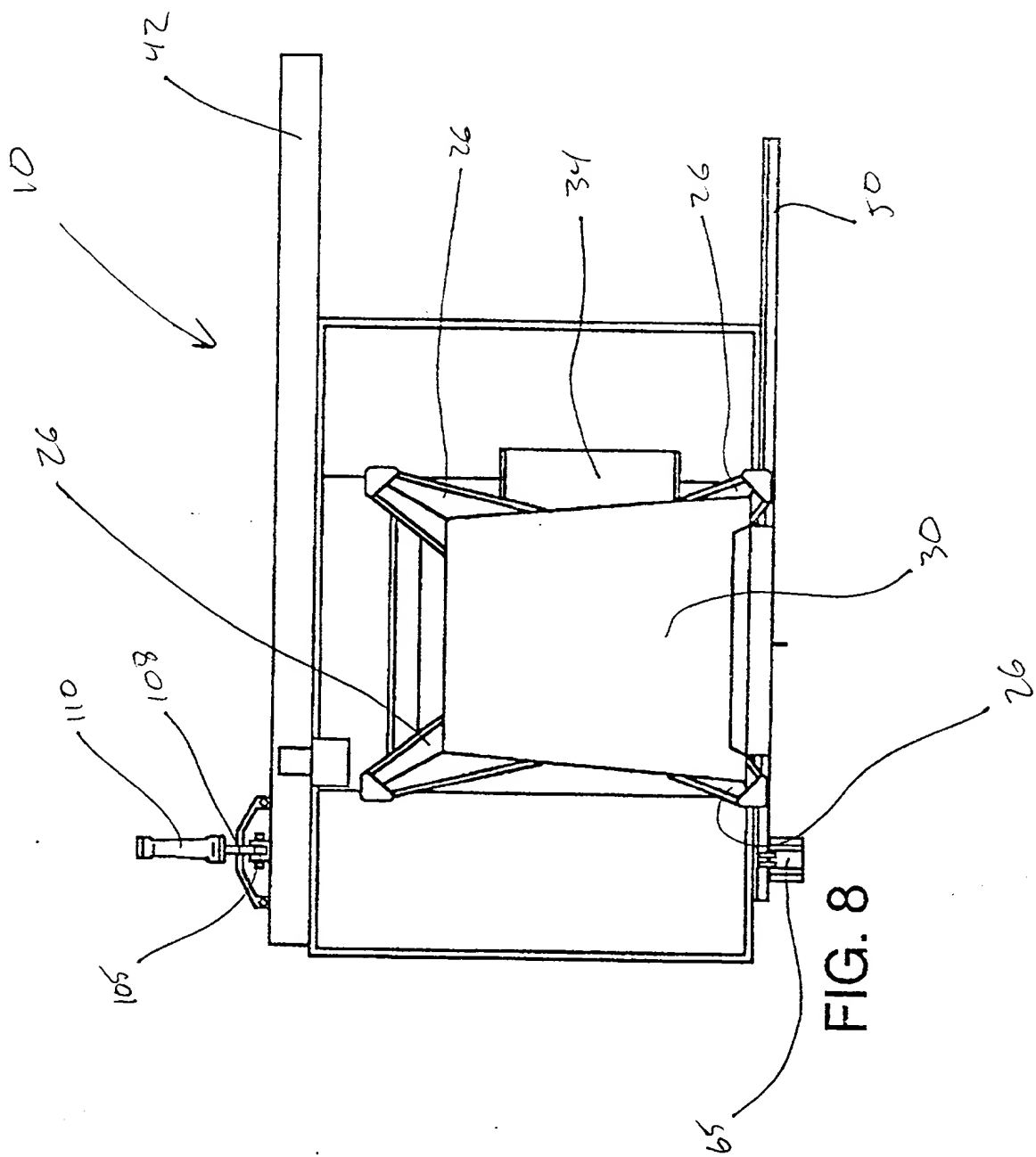
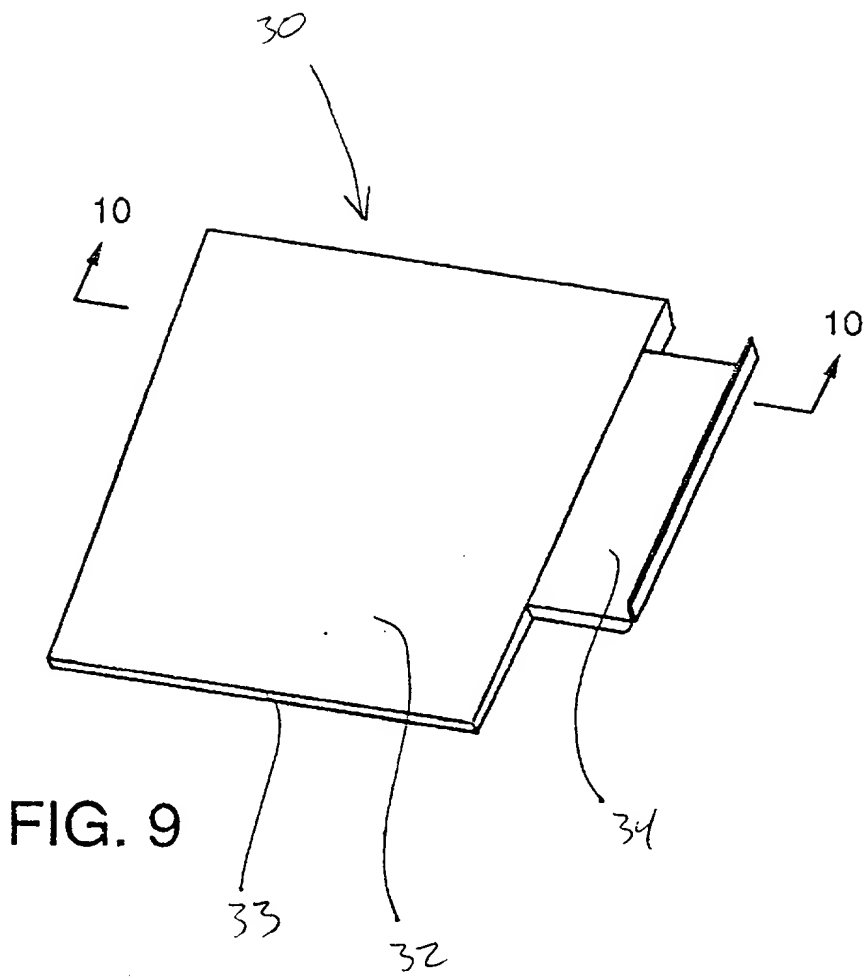


FIG. 5









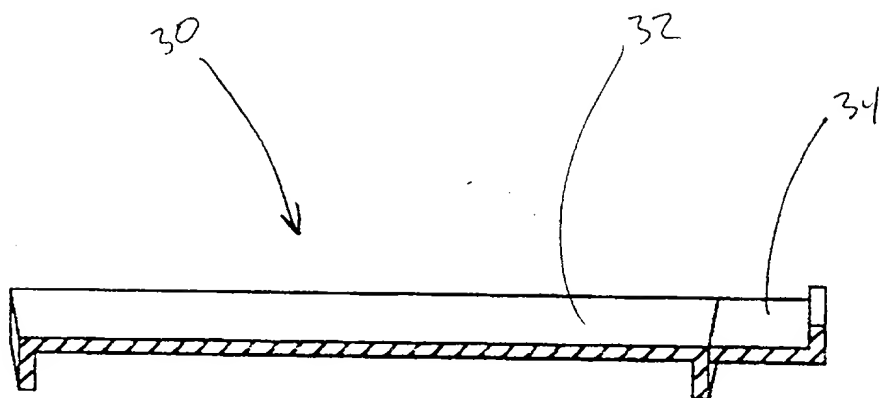


FIG. 10

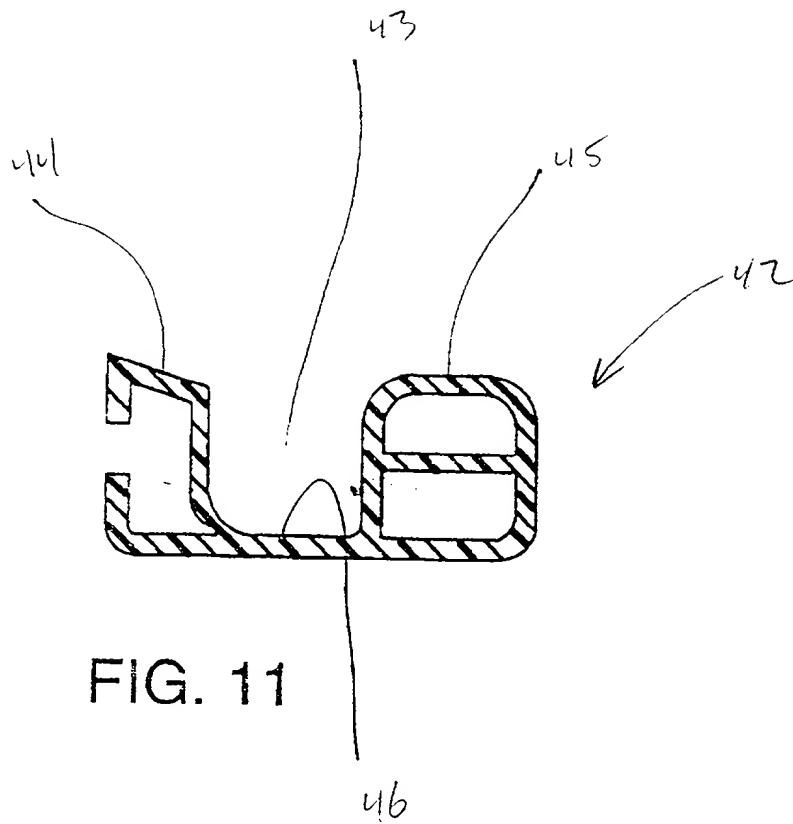


FIG. 11

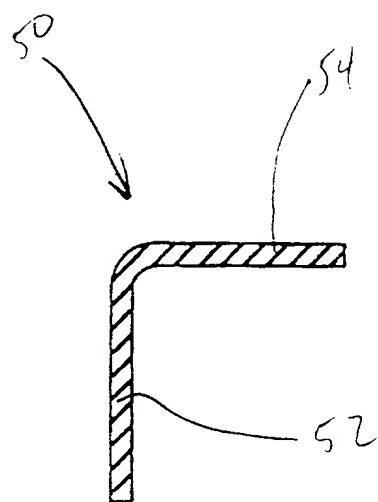


FIG. 12

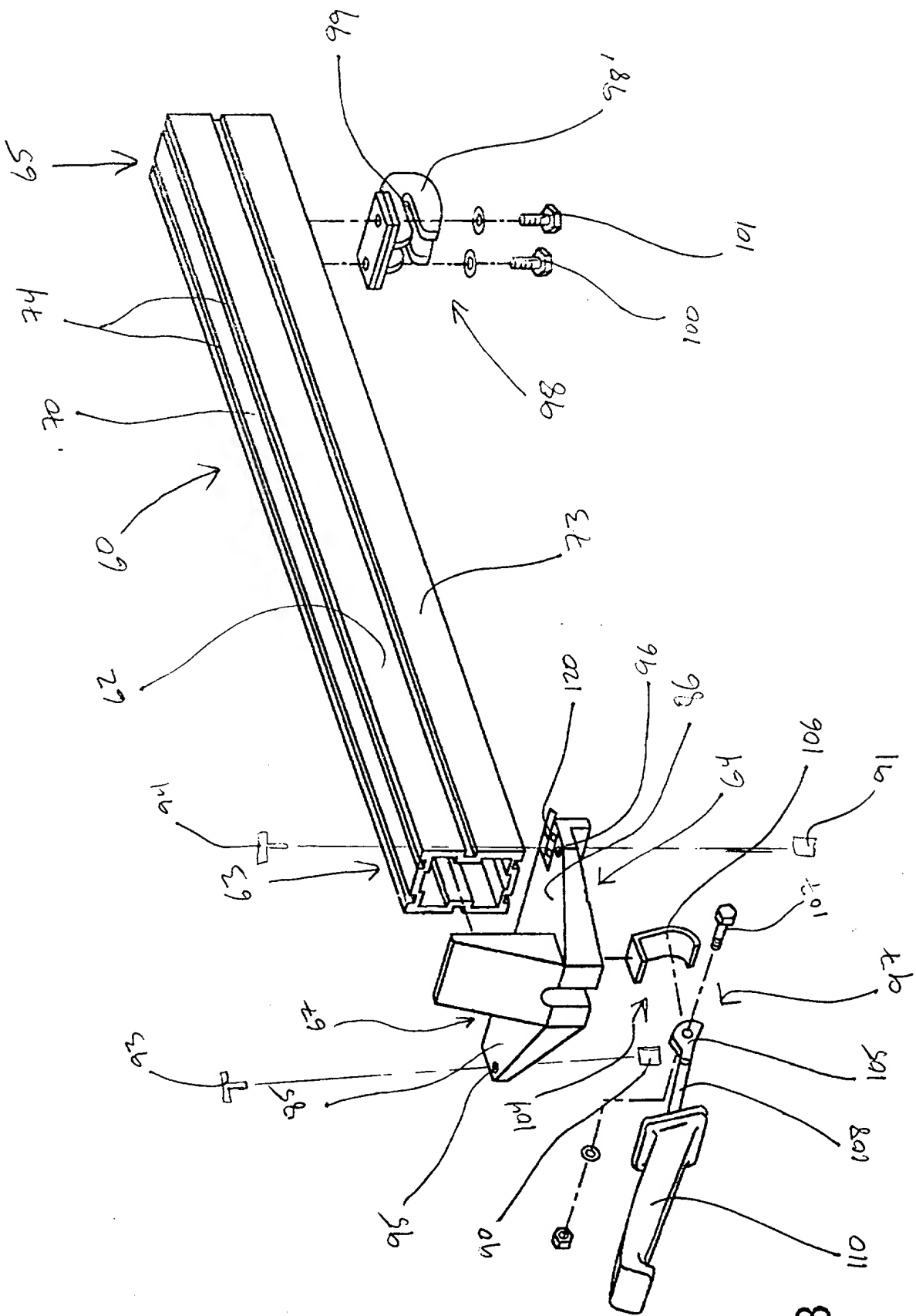
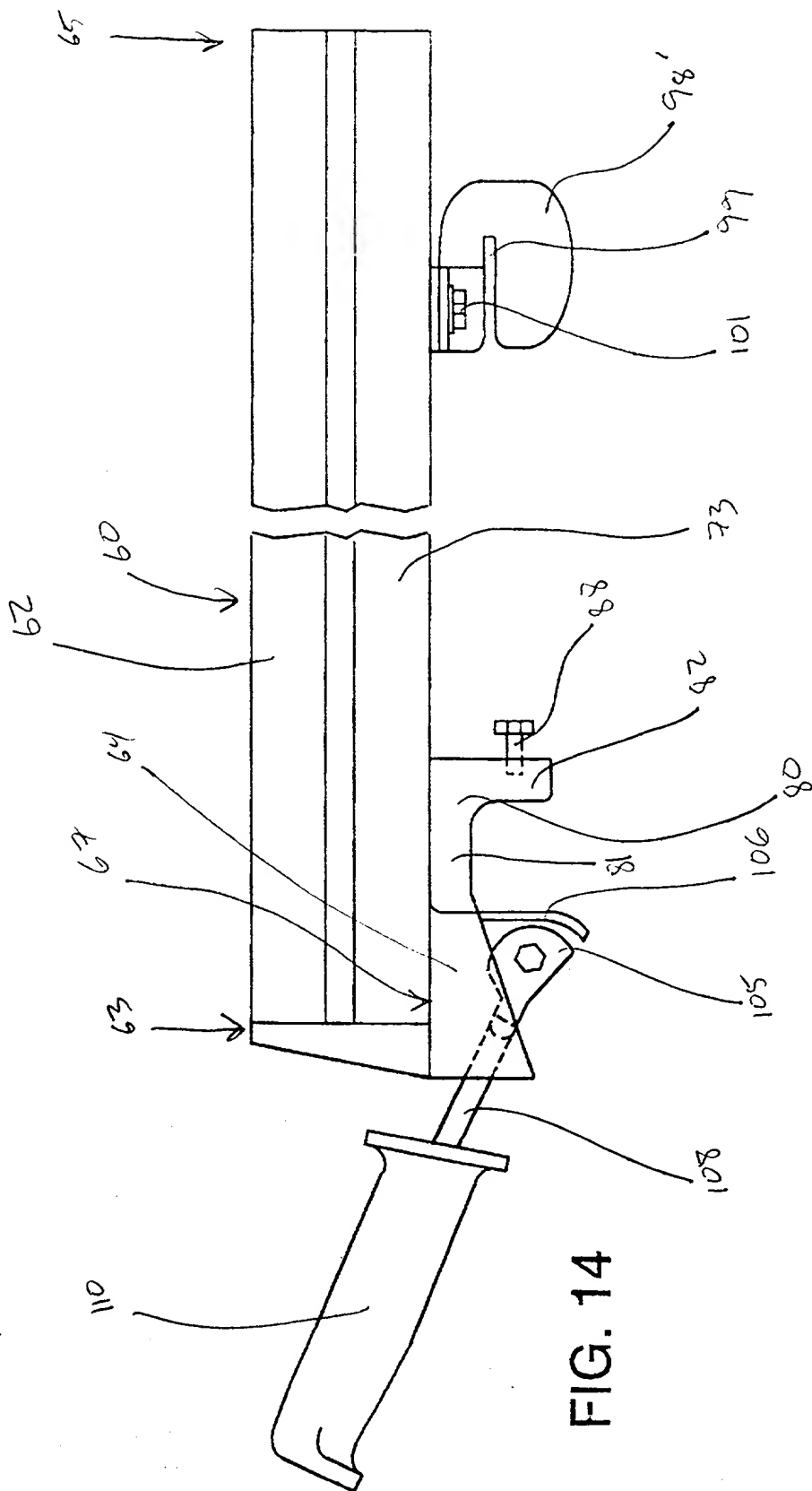


FIG. 13



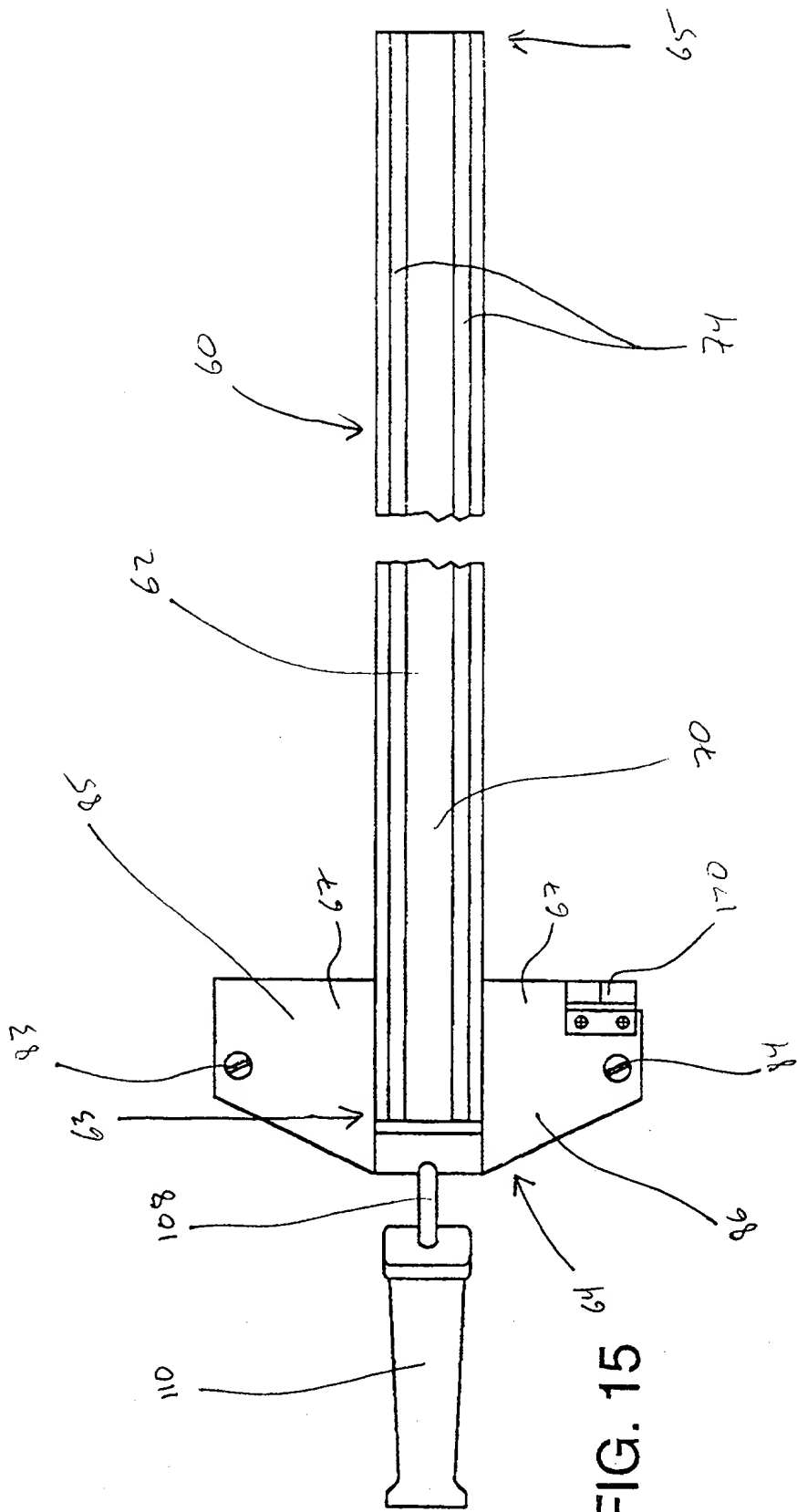


FIG. 15

